REPORT RESUMES

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MOTIVATIONAL VARIABLES IN PROGRAMMED LEARNING. THE ROLE OF NEED ACHIEVEMENT, FEAR OF FAILURE, AND STUDENT ESTIMATE OF ACHIEVEMENT AS A FUNCTION OF PROGRAM DIFFICULTY.

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STUDENTS' LOSS OF INTEREST IN LEARNING AS THE NOVELTY OF PROGRAMMED INSTRUCTION WEARS OFF SUGGESTED THIS STUDY OF MOTIVATION AND ABILITY AS RELATED TO LEARNING RATE. STEP SIZE, ITEM DIFFICULTY, AND PERSONALITY VARIABLES WERE CONSIDERED BEFORE HYPOTHESIZING THAT STUDENTS OF EQUAL ABILITY WHO ARE STRONGLY MOTIVATED TO ACHIEVE WILL PREFER MORE DIFFICULT TEACHING FRAMES THAN STUDENTS WITH A STRONG "FEAR OF FAILURE." MEASURES OF ACHIEVEMENT MOTIVATION AND HOSTILE PRESS (MOTIVATION THROUGH FEAR OF FAILURE) WERE USED TO STUDY THE EFFECTS OF PROGRAM DIFFICULTY, DEFINED AS ERROR RATE, ON ACHIEVEMENT. GRADE 8 STUDENTS WERE RANDOMLY ASSIGNED TO 6 TREATMENTS TO LEARN SET THEORY FROM LINEAR PROGRAMS, HALF WITH CONSTRUCTED RESPONSES. SELF-PACING WAS ALLOWED. SCORES ON PRE-AND POST-TESTS OF ACHIEVEMENT AND ATTITUDE WERE COMPARED BY RIGOROUS SIGNIFICANCE TESTS, GIVING CONSIDERABLE IMPORT TO THESE CONCLUSIONS. STUDENTS HIGH ON HOSTILE PRESS AND ACHIEVEMENT MOTIVATION WERE HIGH ACHIEVERS. HIGH HOSTILE PRESS STUDENTS LEARNED MORE AND WERE MORE FAVORABLE TOWARD HIGH ERROR RATE PROGRAMS THAN LOW ONES, AND LOW HOSTILE PRESS STUDENTS LEARNED MORE AND WERE MORE FAVORABLE TOWARD LOW ERROR RATE PROGRAMS. (LH)

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MOTIVATIONAL VARIABLES IN PROGRAMMED LEARNING

The role of need achievement, fear of failure, and student estimate of achievement as a function of program difficulty

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TABLE OF CONTENTS

Introduction 1

Method . . . .

- Subjects 8
- Materials 9
- Procedure 11

Results . . . .

- Error Rates and Time 13
- Hostile Press - IQ Above the Median. . . . . .
  - (a) High Hostile Press 15
  - (b) Low Hostile Press 18
  - (c) Sex Differences 19
- Hostile Press - IQ Below the Median . . . . .
  - (a) High and Low Hostile Press 21
  - (b) Sex Differences 22
- Need Achievement - IQ Above the Median 25
- Need Achievement - IQ Below the Median 28
- Student Estimate 31
- Correlational Data . . . .
  - Hostile Press 32
  - Need Achievement 33
  - Student Estimate 33
  - IQ and Post-Test and IQ and Retention . . 34

Discussion 35

Conclusions 40

References 42

Appendix A 46

Appendix B 66

INTRODUCTION

A serious problem which will arise from extended use of programmed instruction is the waning of students' interest as the novel format of the material ceases to provide strong stimulation. From informal observations of field tests, the loss of interest may be more acute for the more able students. Several factors may contribute to the decline in interest in programmed material, e.g.

(a) The absence of intellectual exchange with teachers and other students

(b) The rigidity and demands of program structure in shaping the students' response

(c) The high intra- and inter-frame redundancy, including redundancy of response terms (density)

(d) The relative lack of challenge in programs of high redundancy and small step-size.

Whatever the factors which contribute to diminution of interest may be, consideration needs to be given to the potential value of manuipulating one or more motivational variables when self-instructional material is to be used for a sustained period.

A number of articles have appeared which recognize the fallacy in the argument (Skinner, 1958) that programs need not differ for students of different abilities. Lumsdaine (1959) states the early position on a single program for students with a wide range of ability when he writes,

> "Because of this individual pacing to fit each student's rate of progress, even the very

> slow student can gradually be brought up
> to a satisfactory level of accomplishment,
> while the brighter student, after reaching
> a satisfactory level of attainment as fast
> as his abilities permit, can quickly proceed
> to more advanced materials."

Since all learners must respond to each frame in the typical linear program, it is implied that the development of the sequential interlocking frames in the program need not differ for students of different abilities. The program allegedly provides for individual differences through the usual Skinnerian dependent variable, rate of response. This position was questioned early by Kendler (1959), Jensen (1960), and Fusco (1960). A large number of investigators (e.g., Beane, 1962; Burton & Goldbeck, 1962; Campeau, 1965; Campbell, 1964; Carroll, 1963; Coulson & Silberman, 1960; Doty and Doty, 1964; Feldhusen & Eigen, 1963; Gagne & Dick, 1962; Gagne & Paradise, 1961; Hatch & Flint, 1962; Jacobs, 1962(a) and (b); Lambert, Miller, & Wiley, 1962; Lippert & Stolurow, 1963; Shay, 1961; and Smith, 1962) have reported studies in which the findings provide some support for an accentuation of, rather than a reduction in, individual differences by programmed instruction. As the evidence accumulates, it is clear that, "Programmed instruction is going to have to come to terms with differences in student ability. From the evidence accumulated so far, it looks as if the major variable that must be reckoned with is rate of learning." (Carroll, 1963, p. 11)

Although individual differences may be accounted for, in part, through the speed at which students cover the programmed material, requiring all students to respond to frames which they do not need to achieve a high level of proficiency may have a tendency to reduce the motivation of the able students, thus reducing learning efficiency.

One method of maintaining student interest in auto-instructional materials may lie in providing a program with larger steps for the brighter student than for the slower student. Some investigators, e.g., Pressey (1960), suggest that the over-simplification of auto-instructional materials is undesirable. He says, "Some learning is an integrative complexity or a selectivity (or both) beyond what automators now seem to recognize." The implication is, that material presented in a linear, small-step form may be too easy, thereby reducing the level of achievement of the student.[1] Support for Pressey's views is given by Goldbeck (1960) in an investigation in which it was found that students received higher criterion scores following completion of a program of an intermediate level of difficulty (as measured by the number of correct responses on a criterion measure) than did comparable students following completion of programs rated as easy or as very difficult. Goldbeck and Briggs (1960), in discussing this phenomenon, present a partial explanation of why students achieve more on material of intermediate difficulty than on easy material in their statement that, "The dangers of heavy cueing to give a high likelihood of correct responses is that response making may become an automatic activity with none of the advantages of active participation."

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[1] Pask (1958) emphasizes the need for complex problems for maintaining interest when he says, "The fact is that to teach somebody a skill, you must keep his interest concentrated on the job. This in itself recommends the idea of increasing the pace of decision-making. If there are not enough decisions to be made about the job, it is well known that the trainee will be bored."

In addition to varying program difficulty for students, there is evidence also that attention needs to be given to personality or non-intellectual variables as well. Doty and Doty (1964), for example, report a study in which five learner characteristics were varied, viz., grade point average, creativity, social need, achievement need, and attitude toward programmed instruction. Achievement was found to be positively related to grade point average and negatively related to social need, thus the investigators state that, "Students who learned most from the programed material. . .were characterized by relatively low social needs and high academic ability." (p. 336)

Research conducted by Atkinson (1957) on the relation of success in a ring-tossing game to students' attitudes offers a possible explanation for the great variations in student reactions towards programmed instruction. Atkinson believes that a student who is strongly disposed to a "fear of failure" prefers tasks that are extremely easy or extremely hard, and avoids tasks that offer only a 50 percent probability of success because such tasks involve the ego. When a task is extremely easy, the probability of failure is small; when a task is extremely difficult and success is unlikely for anyone, no stigma is attached to failure. When the probability of success becomes greater than 50 percent his interest increases and the task becomes more pleasant for him. On the other hand, the motivation of a student who has a "high hope of success" decreases with continued success or continued failure. It increases as the probability of success approaches the 50 percent level. When free to choose, a student with a "high hope of success" will look for new and more difficult tasks as he masters old ones.

In our opinion, Atkinson's explanation of motivation to achieve could be applied to motivation in programed instruction as well as in the conventional classroom. Specifically, it is proposed that students of the same level of ability who are strongly motivated to achieve will prefer more difficult teaching frames in a learning program than will students who have a strong "fear of failure." If programed materials are to continue to be useful, they must provide not only for individual differences in ability but also for individual differences in motivation to achieve. If our hypothesis is valid, then it is not true that the successful completion of a number of frames is necessarily satisfying to the learner. Our hypothesis suggests that students can no longer be grouped on ability alone and then taught by a difficult, problem-solving method of instruction if they are bright, or by "spoonfeeding" if they are slow. Rather, we must group by level of ability and regroup by type of motivation. The method of instruction for students with "high hope of success" should take the form of difficult problem solving; for students of comparable ability with "fear of failure," some type of "spoonfeeding."

To test our hypothesis that achievement and interest in programed instruction are related to type of motivation as well as to ability, a pilot study was carried out in 1962 using 95 sixth-grade pupils. The Ss were divided into two groups and taught mathematics by programed instruction. Several tests which showed promise as measures of motivation and a projective test were administered at the beginning of the experiment.

The projective test consisted of a six-picture modified TAT scored for Need Achievement (McClelland, 1953) and for Hostile Press (Birney, Teevan, and Burdick, 1961 and 1964; Hancock, 1964). The Hostile Press (HP) scoring system was designed to identify the achieving individual who is pushed to achieve through fear of failure (FF) rather than hope of success. The HP system takes its name from the hostile nature of the story content written by some Ss and which may be described as "press." (Murray, 1938). An abbreviated description of the scoring system will be found in Hancock and Teevan (1964).

Two forms of programed materials, each form consisting of four units of instruction, were developed. The first was an easy form for which S was asked to write the correct response on practically every frame. The second was more difficult and consisted of the same learning program, except that the criterion or test frames were placed earlier in the sequence of material. In this way, Ss given the difficult form were required to respond to some of the frames on the program before they had enough information to provide the correct responses. This procedure made it possible to keep the content and the number of frames comparable for both programs, and at the same time, to change the perceived level of difficulty.

The two groups used the four units of programed material in alternate easy and hard forms. Group A used unit 1 of the easy form, unit 2 of the hard form, unit 3 of the easy form, and unit 4 of the hard form. Group B used unit 1 of the hard form, unit 2 of the easy form, and so on. Since no teachers participated in the instruction, it was assumed that achievement on the mathematics test was a result of working with the learning program only.

In analyzing the data, the various tests of motivation were used as a basis for classification. After classifying the Ss, the achievement test scores on each unit were compared for each group. The results of the analysis show that Ss who differed on one measure of motivation also differed in achievement.

It was found that in the high-achiever group, the "low anxiety"[1] pupils performed equally well on both the easy and hard sequence of programed materials. Their performance seemed to indicate that the order of presentation for this group was of little importance as a motivating variable. We also found that their performance on the achievement measures was consistently higher than the performance of any other group. On the other hand, our comparison of the performance of the high anxiety group of the high achievers indicated that the order of the presentation of materials did affect achievement: the high-achievement, high anxiety group did best on the hard-easy sequence of programed materials.

In the low achiever groups the performance of the pupils seemed to be related to both the level of anxiety and the order of presentation of materials. Specifically, the low-achiever, low-anxiety group appeared to achieve at a higher level on the easy-hard sequence; and the low-achiever, high-anxiety group achieved at the highest level on the hard-easy sequence.

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[1] Anxiety was based on an arithmetic speed test.

The other measures of motivation used in this study did not show any clear relationship to achievement, but they did serve as a stimulus to further investigation.

The purpose of the study presented in this report was to determine the effects of program difficulty (as defined by error rate) on achievement in mathematics when consideration is given to the interaction of ability and two types of motivation.

METHOD

Subjects

The Ss were 526 eighth-grade students, 272 females and 254 males, enrolled in three schools in Williamsport, Pennsylvania.

The Ss were stratified on the basis of sex and randomly assigned to one of six groups. Since there were different schools and teachers involved, equal numbers of Ss from each school and from each class were assigned to each of the groups. After the assignment each group consisted of approximately 87 Ss, 45 females and 42 males. Because of absences of Ss at critical points in the study and the number of measures which each student had to complete, 139 Ss were not included in the main statistical analyses. The original sample of 526 was in order to provide comparative extrinsic motivation for all groups, Ss were told that a portion of their grade in mathematics would be based on their achievement on the experimental materials.

Each S was given the following:

(1) A six-picture modified TAT for Hostile Press (HP) and Need Achievement (n Ach)

(2) Otis Intelligence Scale

(3) Standardized Mathematics Achievement (Calif. M.M.)

(4) Moore-Hancock Test of Student Estimate (See Appendix A, Table III)

(5) Attitude Measures

  (a) General attitude toward programed instruction

(6) Level of aspiration test

  (a) Attitude toward program difficulty

A description of each measure is given in Appendix A, Table II and Table III.

The Otis Intelligence Scale and the Mathematics Achievement score were used as control variables in analyses of covariance. Table I presents the mean intelligence scores and standard deviations for each group.

TABLE I

The means and σ for each group on the intelligence and math. achievement tests

Groups	$\bar{X}$ I.Q.	σ
I	103.23	12.19
II	105.41	12.73
III	103.63	12.73
IV	103.84	16.31
V	102.89	13.60
VI	103.24	12.84

Materials

The first 554 frames of a linear, constructed-response program in mathematics, Introduction to Sets[1], was selected as the subject matter because (a) the Ss were unfamiliar with the material, (b) it was appropriate for the curriculum, (c) the program had been used with success in previous research and (d) mathematics seemed likely to evoke strong drives in many Ss.

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[1] The program was written by Mildred Reigh, Indiana (Pa.) State College and it was field-tested and revised twice prior to its use in this study.

Two additional forms of the mathematics program were developed for the study. A "low error rate" program consisting of 574 frames which (a) included the same criterion and review frames as the original program and (b) presented the same content in smaller steps; i.e., it presented less information in each teaching frame than the original program. A "high error rate" program consisting of 351 frames and which (a) included the same criterion frames and approximately 75 percent of the same review frames as the original program and (b) presented the same content in larger steps; i.e., it presented more information per teaching frame than did the original program. In both modifications of the program, information was presented in a fixed sequence: learning frames, criterion frames, and practice frames. This pattern was approximated in the original program.

As a result of the modifications, three forms of the program were available: a "low error rate" program (hereafter referred to as L), the original program (O), and a "high error rate" program (H). Appendix A, Table I includes a portion of the material on set theory as it was presented in each of the three programs. In addition, each version was presented with and without confirming answers resulting in six programs. Each of the six programs was randomly assigned to one of six groups. The experimental design is presented in Table II.

TABLE II

Experimental Design

Groups	Program
I LA	Low error rate program with answers
II LWA	Low error rate program without answers
III OA	Original program with answers
IV OWA	Original program without answers
V HA	High error rate program with answers
VI HWA	High error rate program without answers

Groups were broken down further to permit analyses for the type of design presented below.

Supplemental Design

		Program											
		LA		LWA		OA		OWA		HA		HWA	
		M	F	M	F	M	F	M	F	M	F	M	F
IQ ABOVE MEDIAN	High Motivation												
	Low Motivation												
IQ BELOW MEDIAN	High Motivation												
	Low Motivation												

Procedure

The modified TAT and the Moore-Hancock Test of Student Estimate were administered to all Ss in their respective classrooms. A pre-test of set theory containing 100 items was administered to all Ss during a regularly scheduled class in mathematics.[1] Pre-test instructions are included in Appendix A, Table IV. In the following meeting of the mathematics class, Es met with Ss and instructed them in the use of programmed material. During this session, Ss worked through a sample program of 29 frames with confirming responses. Instructions for the use of the program are given in Appendix A, Table V. Subjects were instructed to keep the answer concealed until they had responded to the frame. Work sheets were provided on which Ss recorded their responses. Subjects were told that errors on the program would not affect their score on the examination; however, if they responded incorrectly, they were asked to try to locate the error but not to change the incorrect answer. In this way, E was able to correct the work sheets and obtain an error rate for each S. Subjects were told that an achievement test would be given after they had completed the program.

On the following day, Ss started work on the program assigned during their regularly scheduled class in mathematics, and continued to work on the program for 35-40 minutes daily until it was completed. Each class was supervised by a teacher who provided Ss with no instruction on the program. Instructions for administrators are given in Appendix A, Table VI. Teachers were responsible for the supervision of the class, the distribution and collection of materials, and the tabulation of the time required to complete the task. When S completed the program he was given the achievement test in set theory and the attitude measures. The attitude measures and the technique for scoring them are presented in Appendix A, Table VII. Following post-testing, Ss were assigned work on a spelling program until all Ss had finished the mathematics program. This procedure permitted S to work at his own pace. The class schedule for the three schools is presented in Appendix A, Table VIII. Approximately six months following completion of the learning phase of the study, Ss were tested for retention. The experiment was run during the last six weeks of the academic year and required approximately twenty-four sessions.

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[1] The same test was used as a pre-, post-, and retention test. A copy of the test is contained in Table IX, Appendix A.

RESULTS

Error Rate and Time

To determine the difficulty of the programs, a mean error rate for each program was computed. In order to compute error rates a random sample of 20 Ss was selected from each of the six groups. Errors were tabulated for the first 100 frames, for the middle 100 frames, and for the final 100 frames of each program. Table III presents the mean percent of errors for each group.

TABLE III

Mean percent errors on sample frames for each group

	Program					
	LA	LWA	OA	OWA	HA	HWA
High IQ*	9.02	17.62	10.40	29.55	17.31	31.15
Low IQ	24.43	47.47	32.88	70.10	30.71	69.24
Totals	18.41	32.79	23.26	51.46	24.41	51.10

*High IQ refers to scores above the median while low IQ refers to scores below the median.

It is rather clear that it is not entirely accurate to refer to the three basic programs as low error, medium error (original version) and high error programs. From the data obtained, the difficulty lies with the H version which does not differ from the original program in mean number of errors for the total sample even though the same content is presented in substantially fewer frames. The label H will be used throughout the report; however, caution will be needed in interpreting differences, if any, between OWA and HWA and, in addition, for low IQ Ss between OA and HA.

The time needed to complete each program was computed and the mean time of completion by group is presented in Table IV.

TABLE IV

Mean time for completion of program by group

Group	$\overline{X}$ hours
LA	19.42
LWA	18.87
OA	14.46
OWA	14.53
HA	11.44
HWA	11.93

As can be observed from Table IV, as the number of frames in the program increased, the amount of time needed to complete the program increased. It is of interest to note that the presence or absence of confirmation did not contribute to the amount of time required to complete any given version of the program.

Hostile Press - IQ Above Median

(a) High HP

To determine the effects of version of program for Ss classified as high HP or low HP (i.e., above or below the median on HP), a two-way analysis of covariance using Otis Intelligence scores and mathematics aptitude scores as control variables was completed for (1) post-test achievement scores on set theory and (2) retention test scores on set theory. Tables V and VI present the results of the analyses of these data for male and female Ss who were above the median in IQ.

TABLE V

High IQ males and females on high and low HP on post-test (achievement)

Source	DF	Σ of Sqrs.	$\overline{X}$ sqr.	F	
Hostile Press	1	1148.007	1148.007	6.182	<.05
Program	5	2178.219	435.644	2.346	<.05
Interaction	1	1375.253	1375.253	7.405	<.01
Within	182	33800.557	185.717		

As can be observed in Table V, a significant F was obtained for (1) program, (2) hostile press, and (3) the interaction of hostile press and program and from Table VI, a significant F for program and the interaction of program and hostile press.

TABLE VI

High IQ males and females on high and low HP on retention test

Source	DF	Σ of Sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	402.435	402.435	2.710	ns
Program	5	1929.951	385.990	2.590	<.05
Interaction	1	934.542	934.542	6.272	<.05
Within	166	24733.735	148.998		

The means for the six groups are presented in Table VII and Table VIII. The *t*-test was used to compare the means on the post-test and the retention test.

TABLE VII

Adjusted mean scores for high IQ, high and low HP males and females on post-test and retention test

High Hostile Press	N	Post-test	N	Retention test
Low error rate with answers	16	57.1	14	44.4
Low error rate without answers	16	67.6	14	52.9
Original with answers	19	72.6	19	52.6
Original without answers	18	65.1	16	45.6
High error rate with answers	14	66.8	14	50.5
High error rate without answers	20	65.8	18	56.7
Totals	103	66.3	95	51.4
Low Hostile Press	**N**	**Post-test**	**N**	**Retention test**
Low error rate with answers	10	61.3	9	48.8
Low error rate without answers	17	61.3	16	51.2
Original with answers	16	63.4	15	47.5
Original without answers	13	64.6	12	49.3
High error rate with answers	19	53.9	17	41.0
High error rate without answers	14	64.5	12	50.9
Totals	89	60.7	81	47.0

TABLE VIII

Adjusted mean scores of high IQ males and females combining the high and low HP groups

Program	N	Adjusted $\overline{X}$ Post	N	Adjusted $\overline{X}$ Retention
Low error rate with answers	26	56.89	23	45.8
Low error rate without answers	33	66.4	30	52.0
Original with answers	35	67.1	34	50.4
Original without answers	31	65.1	28	47.1
High error rate with answers	33	59.4	31	45.3
High error rate without answers	34	65.9	30	54.4
Totals	192	63.7	176	49.3

A comparison of the post-test means for the *high* HP groups indicated:

(1) The mean for OA was significantly greater ($p < .02$) than the mean for LA.

(2) The mean for HA was greater ($p < .07$) than the mean for LA.

(3) The mean for OA was greater ($p < .10$) than the mean for HWA.

For the retention test, two differences approached significance among the means for the *high* HP groups, *viz*.

(1) The mean for HWA was greater ($p < .06$) than the mean for LA.

(2) The mean for HWA was greater ($p < .08$) than the mean for OWA.

(b) Low HP

The means for the post-test and the retention test for _low_ HP _S_s (Table VII) also were compared through a t-test analysis. No significant differences were found although it should be noted that with the exception of Group LA, the mean post-test score was higher for high HP _S_s in each group than for the low HP _S_s. Thus, it would appear that the significant F for program (Table V) on the post-test of achievement reflected differences between the means of OA and the means of (a) LA and (b) HA (Table VIII). In both cases the mean for OA was significantly higher ($p < .025$).

A comparison of the mean retention scores (Table VIII) for each of the six groups (high IQ only) indicated that:

HWA was greater than HA ($p < .025$)
HWA was greater than LA ($p < .05$)

The significant interaction effect between program and hostile press presented in Table V and Table VI seemingly may be attributable, in part, to the significantly higher scores attained by high HP _S_s in OA and in HA than were attained by high HP _S_s in LA ($p < .01$ and .07 respectively) and, in part, to the tendency of low HP _S_s in HA to achieve less than low HP _S_s in OA or HWA. (See Table VII).

It is of some interest, also, to note that high HP _S_s achieved more on the low error rate program _without_ answers than high HP _S_s did on the same program with answers. Further, high HP _S_s who worked on the original program ("medium" error rate) _without_ answers, also achieved more than did high HP _S_s on the original program _with_ answers.

Low HP Ss who worked with the "high" error rate program without answers tended to achieve more than did the low HP Ss who worked with the same program with answers.

(c) Sex Differences

Most of the work which has been done with the Hostile Press system of identifying fear of failure individuals has been conducted on males. For this reason, the post-test and retention scores of high IQ males and females were analyzed separately (Table IX and Table X). Since the N's were small, the six groups, i.e., treatment by program, were reduced to three, viz., LA + LWA, OA + OWA, and HA + HWA.

TABLE IX

High IA males on high and low Hostile Press for post-test or combined programs

Source	DF	Σ of Sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	195.719	195.719	1.033	NS
Program	2	2366.978	1183.489	6.248	<.01
Interaction	1	156.388	156.388	.826	NS
Within	83	15722.321	189.426		

TABLE X

High IQ males on high and low Hostile Press for retention test

Source	DF	Σ of Sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	303.595	303.595	1.679	NS
Program	2	167.279	83.640	.463	NS
Interaction	1	268.349	268.349	1.484	NS
Within	74	13381.626	180.833		

Only one variable was significant and that was program (Table IX). Subjects in O achieved significantly higher scores on the post-test of achievement than did Ss in L ($\underline{p} < .025$) or in H ($\underline{p} < .025$). The total adjusted means for the high IQ males on the post-test are given in Table XI. The mean post-test and retention test scores for each of the groups of males are presented in Appendix B, Table I.

TABLE XI

Total adjusted means for post-test combining the high and low Hostile Press for high IQ males

Program	N	Adj. post-test
Low error rate with answers	23	56.2
Low error rate without answers	23	56.2
Original with answers	32	67.5
Original without answers	32	67.5
High error rate with answers	35	57.1
High error rate without answers	35	57.1
Total	90	60.6

Tables XII and XIII present the analyses of the data for females who were above the median in IQ.

TABLE XII

High IQ females on high and low Hostile Press for post-test on combined programs

Source	DF	Σ of Sqrs.	$\bar{X}$ sqr.	F
Hostile Press	1	308.647	308.647	1.826 NS
Program	2	63.893	31.946	.189 NS
Interaction	1	421.661	421.661	2.494 NS
Within	103	17411.336	169.042	

TABLE XIII

High IQ females on high and low Hostile Press for retention test

Source	DF	Σ of Sqrs.	$\overline{X}$ sqr.	F
Hostile Press	1	2.696	2.696	.017 NS
Program	2	733.457	366.728	2.328 NS
Interaction	1	441.208	441.208	2.801 NS
Within	97	15279.698	157.523	

Again, because of low N's groups were combined as they were for male Ss. The means for the several groups are presented in Appendix B, Table II.

None of the F's in these analyses was significant; however, the trend observed in the combined analysis of male and female Ss on post-test scores (Table VII) was observed in this group also, with low HP Ss in L tending to achieve more than low HP Ss in the other groups and the high HP Ss in H tending to achieve more than the high HP Ss in the other groups.

Hostile Press - IQ Below Median

(a) High and Low Hostile Press

To determine the effects of the differing programs Hostile Press, and the interaction of these two variables on the achievement and retention of Ss who were below the in IQ, analyses of covariance, with IQ and achievement as control variables were done. Tables XIV and XV present these analyses.

TABLE XIV

Low IQ males and females on high and low Hostile Press on post-test

Source	DF	Σ of Sqrs.	$\overline{X}$ sqr.	F	
Hostile Press	1	31.541	31.541	.162	NS
Program	5	934.603	186.921	.962	NS
Interaction	1	341.620	341.620	1.757	NS
Within	187	36352.670	194.399		

TABLE XV

Low IQ males and females on high and low Hostile Press on retention test

Source	DF	Σ of Sqrs.	$\overline{X}$ sqr.	F	
Hostile Press	1	84.697	84.697	.777	NS
Program	5	272.217	54.443	.499	NS
Interaction	1	335.214	335.214	3.074	NS
Within	166	18102.521	109.051		

None of the F's in these analyses was significant, although, again, the high HP Ss tended to achieve at a higher level on both dependent variables than the low HP Ss. Means for each of the six groups are given in Appendix B, Table III.

(b) Sex Differences

Tables XVI and XVII present the results of comparing low IQ males on the two independent variables.

TABLE XVI

Low IQ males on high and low Hostile Press on post-test for combined programs

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	39.966	39.966	.222	NS
Program	2	142.447	71.224	.396	NS
Interaction	1	307.405	307.405	1.707	NS
Within	85	15304.297	180.050		

TABLE XVII

Low IQ males on high and low Hostile Press on retention for combined programs

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	244.933	244.933	2.771	NS
Program	2	372.092	186.046	2.105	NS
Interaction	1	307.852	307.852	3.483	
Within	73	6451.572	88.378		

Because of low N's, groups were combined for analysis into L, O, and H as was done for high IQ males. None of the comparisons differed significantly; although the tendency of high HP Ss to achieve more than low HP Ss was noted. The means for the two dependent variables for these groups are presented in Appendix B, Table IV.

Results similar to those found for the low IQ males were obtained for the low IQ females. (Table XVIII and Table XIX). Because of low N's, the groups were combined and the data analyzed as described above.

TABLE XVIII

Low IQ females on high and low Hostile Press on post-test for combined programs

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	21.400	21.400	.125	NS
Program	2	696.181	348.090	2.040	NS
Interaction	1	65.779	65.779	.385	NS
Within	86	14675.313	170.643		

TABLE XIX

Low IQ females on high and low Hostile Press on retention test for combined programs

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Hostile Press	1	72.198	72.198	.912	NS
Program	2	70.316	35.158	.444	NS
Interaction	1	296.550	296.550	3.746	NS
Within	78	6175.172	79.169		

Although none of the F's was significant, two trends which were noted in other analyses were observed. First, the means of the high HP Ss were higher than the means of low HP Ss on both the post and retention test; second, the high HP Ss in Group HA tended to achieve more than the HP Ss in Group LA on both dependent variables. The reverse of this trend was noted for the low HP Ss. The means of the six groups for this analysis are presented in Appendix B, Table V.

Need Achievement - IQ Above the Median

To determine the effects of (1) differing versions of the program, (2) need achievement (n Ach), and (3) the interaction of these two variables on the two dependent variables, an analysis of covariance two-way classification, using IQ and standardized mathematics achievement scores as control variables, was employed. The results of these analyses are presented in Tables XX and XXI.

TABLE XX

High IQ Ss on high and low need achievement on post-test

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need achievement	1	-.056	-.056	.0003	NS
Program	5	1789.476	357.895	1.792	NS
Interaction	1	437.898	437.898	2.193	NS
Within	177	35333.169	199.622		

TABLE XXI

High IQ Ss on high and low need achievement on retention test

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need achievement	1	1.667	1.667	.010	NS
Program	5	1653.276	330.655	2.063	NS
Interaction	1	976.715	976.715	6.095	$<.05$
Within	162	25960.381	160.249		

None of the F's for the post-test analysis was significant and only the interaction F for the retention test was significant.

The t-test was utilized to compare the means on the retention tests for the six groups for high and low n Ach. Table XXII presents the means and the comparisons which differed significantly. The mean post-test scores will be found in Appendix B, Table VI.

TABLE XXII

Adjusted mean scores on retention test for high IQ Ss on high and low need achievement

High need achievement			Low need achievement	
Group	N	Adjusted Retention	N	Adjusted Retention
LA	15	46.7	8	44.3
LWA	21	53.3	9	49.7
OA	17	48.4	17	49.4
OWA	12	45.6	14	49.6
HA	19	43.1	11	51.5
HWA	17	57.0	12	50.9
Totals	101	49.5	71	49.0

As can be observed in Table XXII none of the comparisons for low n Ach Ss differed significantly, while high n Ach Ss in HWA achieved significantly more than the high n Ach Ss in HA ($p<.05$).

To determine the effects of n Ach and program on males only, an analysis of covariance was completed for males with IQ's above the median, using the same control and dependent variables. Since the N's for the cells were small, groups were reduced to L, O, and H. These analyses are presented in Table XXIII and Table XXIV.

TABLE XXIII

High IQ males compared on need achievement for post-test on combined groups

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need achievement	1	2.469	2.469	.012	NS
Program	2	2096.260	1048.130	5.308	.01
Interaction	1	492.497	492.497	2.494	NS
Within	78	15400.606	197.444		

TABLE XXIV

High IQ males compared on need achievement for retention test on combined groups

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need achievement	1	58.457	58.457	.305	NS
Program	2	158.562	79.281	.414	NS
Interaction	1	29.430	29.430	.154	NS
Within	71	13595.416	191.485		

In these analyses, Ss differed on the program variable, only differ with Ss achieving significantly higher means in O than in L or H ($p < .025$ in both cases). Table XXV presents these data.

TABLE XXV

Adjusted means for high IQ males on combined need achievement dimensions for combined programs

Program		N	Adjusted Post
Low error rate with and without answers	(L)	22	55.5
Original with and without answers	(O)	20	66.8
High error rate with and without answers	(H)	33	57.1
Totals		85	60.1

The means for the analysis of both the post- and the retention tests are presented in Appendix B, Table VII. The same procedure was followed for females and the results are presented in Table XXVI and Table XXVII

TABLE XXVI

High IQ females on high and low Need Achievement for combined programs on post-test

Sources	DF	Σ of sqrs.	$\overline{X}$ sqr.	F
Need Achievement	1	.230	.230	.001 NS
Program	2	9.681	4.840	.024 NS
Interaction	1	89.490	89.490	.449 NS
Within	103	20515.864	199.183	

TABLE XXVII

High IQ females on high and low Need Achievement for combined programs on retention test

Sources	DF	Σ of sqrs.	$\overline{X}$ sqr.	F
Need Achievement	1	1.076	1.076	.007 NS
Program	2	899.494	449.747	2.948 NS
Interaction	1	205.807	205.807	1.349 NS
Within	95	14495.509	152.584	

None of the F's was significant. Appendix B, Table VIII contains the means for these groups for both the post-test and the retention test.

Need Achievement - IQ Below the Median

An analysis of covariance was done to compare the effects of need achievement, program difficulty and the interaction of these two variables on the post-test and the retention test of Ss below the median IQ. Control variables were IQ and standardized mathematics achievement scores. (Tables XXVIII and XXIX)

TABLE XXVIII

Low IQ Ss on high and low Need Achievement for post-test

Source	DF	Σ of sqrs.	$\overline{X}$ sqr.	F	
Need Achievement	1	1982.091	1982.091	10.914	<.01
Program	5	1025.946	205.189	1.130	NS
Interaction	1	510.033	510.033	2.808	NS
Within	185	33598.926	181.616		

TABLE XXIX

Low IQ Ss on high and low Need Achievement for retention test

Source	DF	Σ of sqrs.	$\overline{X}$ sqr.	F	
Need Achievement	1	998.294	998.294	9.624	<.01
Program	5	256.578	51.316	.495	NS
Interaction	1	329.484	329.484	3.176	NS
Within	165	17115.804	103.732		

For this analysis, only the F for n Ach was significant with high n Ach achieving significantly more than low n Ach Ss. The means are presented in Appendix B, Table IX.

Tables XXX and XXXI present the results of the analysis for male Ss on the two dependent variables.

TABLE XXX

Low IQ males on high and low Need Achievement for combined programs on post-test

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need Achievement	1	9.342	9.342	.053	NS
Program	2	91.593	45.796	.258	NS
Interaction	1	481.360	481.360	2.717	NS
Within	82	14528.599	177.178		

TABLE XXXI

Low IQ males on high and low Need Achievement for combined programs on retention test

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need Achievement	1	34.576	34.576	.351	NS
Program	2	266.537	133.268	1.354	NS
Interaction	1	3.827	3.827	.039	NS
Within	71	6987.350	98.413		

None of the F's reached significance. The means are presented in Appendix B, Table X.

Tables XXXII and XXXIII present the results of the analysis for female Ss who were below the median in IQ.

TABLE XXXII

Low IQ females on high and low Need Achievement for post-test

Source	DF	Σ of sqrs.	$\bar{X}$ sqr.	F	
Need Achievement	1	1034.408	1034.408	6.655	<.05
Program	2	921.496	460.748	2.964	NS
Interaction	1	-187.890	-187.890	1.209	NS
Within	85	13211.381	155.428		

TABLE XXXIII

Low IQ females on high and low Need Achievement for retention test

Source	DF	Σ of sqrs.	$\overline{X}$ sqr.	F	
Need Achievement	1	515.367	515.367	6.672	<.05
Program	2	85.693	42.846	.555	NS
Interaction	1	69.643	69.643	.902	NS
Within	76	5870.355	77.242		

As can be observed in these tables, differences for the program variable were not significant. On the other hand, significant F's for n Ach were obtained for both post- and retention tests. In both cases high n Ach Ss scored significantly more. The means are presented in Appendix B, Table XI.

Student Estimate

A two-way analysis of variance was utilized to determine the effects of (1) program, (2) Moore-Hancock Student Estimate of Achievement (SE), and the interaction of these two variables on post-test achievement. The results of the analysis are presented in Table XXXIV. The mean post-test scores for the six groups are given in Table XXXV.

TABLE XXXIV

Analysis of post-test scores on high and low student estimate

Source	S.S.	df	M.S.	F	P
Between gps.	14743.296	11	1340.300	2.876	<.01
1. Programs	3335.192	5	667.038	1.431	NS
2. Stu. Est.	7863.946	1	7863.946	16.874	<.01
3. Interaction	3544.158	5	708.832	1.521	NS
Within gps.	106255.000	228	466.031	▨	▨
Totals	120998.296	239			

F_{05} = 1.76

TABLE XXXV

Mean scores on E groups when dichotomized on student estimate

	LA	LWA	OA	OWA	HA	HWA
High S.E.	(13) 44.077	(19) 42.637	(25) 48.360	(20) 47.900	(18) 38.500	(27) 46.296
Low S.E.	(18) 47.444	(25) 61.560	(14) 64.429	(22) 53.545	(22) 49.409	(17) 64.941

The F's for program and for interaction were non-significant. The groups which underestimated their achievement scored significantly higher on the post-test than did those which overestimated their achievement.

Correlational Data

Hostile Press

Point-biserial correlations were used to determine the relationship between hostile press and (1) IQ, and (2) post-test achievement. Hostile press and IQ were not significantly related. A correlation of +.20 (N=405, $p <.01$) was found between hostile press and post-test achievement with all groups combined. When broken down by groups and by IQ, the correlation between achievement and hostile press in the high IQ group was only .04 ($p <.05$) for all *Ss* combined; as would be expected, all *r*'s within groups were non-significant. The correlation between achievement and hostile press for all *Ss* in the low IQ group was +.182 (N=200, t=2.60, $p<.01$). Correlations of +.392 (N=29, t=2.22, $p<.05$) and +.347 (N=34, t=2.13, $p<.05$) were obtained between these two variables for group LA and group OA.

Tetrachoric correlations were computed between need achievement and hostile press for (1) all *Ss*, (2) males only, (3) females only, (4) high IQ *Ss* and (5) low IQ *Ss*. None of the correlations was significant although for total boys, r_t was +.17 (*p*=.07). Computations also were done by groups for the same five classifications. Only the following were significant:

Total *S*s in HWA, r_t = .35 (p=.04)
Boys in LA, r_t = .46 (p=.06)
Girls in LA, r_t = -.58 (p=.02)
Low IQ *S*s in HWA, r_t = .69 (p <.01)

Need Achievement

The point-biserial correlation between n Ach and the post-test of achievement for all *S*s (N=393) was .16 (*p* <.01) and for boys only (N=186) *r* was +.185 (*t*=2.55, *p*<.02). When broken down by groups, the *r*'s for all *S*s were:

LA N = 58 *r*= .202 (*t* = 1.5, *p* > .05)
LWA N = 62 *r*= .39 (*t* = 3.31, p < .01)
OA N = 69 *r*= .00 (p > .05)
OWA N = 66 *r*= .04 (p > .05)
HA N = 68 *r*= .31 (*t* = 2.62, *p* <.02)
HWA N = 70 *r*= .24 (*t* = 2.00, *p* <.05)

A comparison of n Ach and achievement by IQ yielded results similar to those found for hostile press, *viz*., the *r* for the high IQ group was non-significant (*r* = .03) while the *r* for the low IQ group was +.252 (*t* =3.66, *p* <.001).

Student Estimate

Rank order correlations between the post-test of achievement and SE were computed and significant rho's were found in four of the six groups (Table XXXVI).

TABLE XXXVI

Rank-Order Correlations Post-test and Student Estimate

Groups	N	r	p
1	34	-.038	insig
2	45	-.312	<.05
3	40	-.320	<.05
4	44	-.371	<.01
5	40	-.189	insig
6	44	-.401	<.01

TABLE XXXVII

Rank-Order Correlation between Moore-Hancock Student Estimate and IQ

Groups	N	Rank Difference Correlation Coefficients	p
1	31	r = .634	<.01
2	44	r = -.288	<.05
3	39	r = -.306	<.05
4	42	r = -.283	<.05
5	39	r = -.445	<.005
6	43	r = -.419	<.005

Rho's also were computed between IQ and SE (Table XXXVII). The relationship was significant for each group and for all Ss combined.

IQ and Post-Test; IQ and Retention

Product-moment correlations were obtained between the post-test of achievement and IQ and between the retention test and IQ. The data are given in Table XXXVIII.

Significant r's were obtained in all groups between IQ and the two dependent variables.

TABLE XXXVIII

Product-Moment Correlations post- and retention test scores and IQ

Groups	Post-test			Retention		
	N	r	p	N	r	p
1	60	.640	<.01	56	.699	<.01
2	69	.759	<.01	65	.792	<.01
3	67	.666	<.01	62	.632	<.01
4	68	.684	<.01	60	.759	<.01
5	69	.782	<.01	62	.792	<.01
6	70	.717	<.01	62	.731	<.01

DISCUSSION

The results of the comparison of "difficulty" of program as one variable and high and low HP as the other tend to support the hypotheses that (1) fear of failure motivation is a variable in the achievement of S, and (2) "difficulty" of program, when tailored to the motivational characteristics of Ss, affects achievement. The significantly higher scores achieved on the post-test by the combined male and female high IQ Ss provide evidence which supports the first hypothesis (Table V and Table VII). Although significant differences in favor of the high HP Ss were restricted to the combined high IQ groups, the fact that the means of the groups, when stratified on sex, consistently favored the high HP Ss provides further support for the hypothesis (Tables I and II of Appendix B). The failure of the high IQ groups, when stratified on sex, to differ significantly on the hostile press variable may be a function of the relatively small N's which resulted after the stratification on sex.

Additional support for this hypothesis was observed in the analysis of the low IQ groups on the hostile press variable. Again, all the means on both the post-test and the retention test consistently favored high HP Ss (Appendix B, Tables III, IV and V). If the LA program was too difficult for the low IQ Ss, it may account for the failure to obtain significant differences among these groups. Examination of the error rate for the high IQ and the low IQ Ss tends to support this conclusion.

The second method of classifying Ss on motivational variables; viz., by need achievement, was less productive as a determiner of the level of achievement for high IQ Ss than it was for low IQ Ss. It was found that Ss with above-average IQ's did not differ in level of achievement as a function of the n Ach variable (Appendix B, Tables VI, VII, and VIII). The high n Ach Ss (combined male and female) in the below-average IQ groups scored significantly higher on the post-test than did the low n Ach Ss (Appendix B, Table IX).

For the Moore-Hancock Test of Student Estimate, it was found that Ss who underestimated their achievement tended to score significantly higher than did Ss who tended to overestimate their achievement (Table XXXVI). However, since the correlation between Student Estimate and IQ were significant as was the correlation between IQ and the post-test of achievement (Table XXXVII), it is suggested that this SE may provide a quantitative assessment of motivation, but a measure contaminated by IQ. These analyses further support the hypothesis that motivational determiners affect achievement.

The implication of these findings is not unique, in the sense that the relationship of motivation and achievement is in itself a new finding; rather, the significance lies in the fact that the variables can be assessed in quantifiable terms.

The findings provide some support for the hypothesis that achievement is a function of the interaction of "difficulty" of program and motivational characteristics. From the analysis of the data on the achievement of high IQ Ss (Table VII) it may be inferred that increasing the difficulty of a program for high HP Ss, results in an increase in their achievement, while increasing the difficulty of a program for low HP Ss decreases their achievement. In this case, high HP Ss in Group HA achieved significantly higher scores than high HP Ss in Group LA, while the low HP Ss in Group LA tended to achieve higher scores than low HP Ss in Group HA.

Since these findings were not replicated for the variables n Ach and SE, the fear of failure measure of motivation seems to be the most meaningful for determining the appropriate level of program "difficulty" for a given learner where difficulty is defined in terms of error rate. Further, the results are consistent with Atkinson's finding (1957) concerning Ss classified as "motivated to achieve" and "fear of failure", where the interaction of the probability of success and the motivational characteristics of the Ss determined the length of time the S continued to participate in the experimental task.

An analysis of the attitude scale indicated that S's motivation may be related to their attitudes toward the mode of learning. All of the high HP groups tended to have favorable attitudes toward programmed instruction while the low HP groups tended to have unfavorable attitudes toward programmed instruction. High HP Ss in Group HA had significantly more favorable attitudes than the low HP Ss in Group HA.

The n Ach groups had attitudes similar to those of the hostile press Ss, with the high n Ach Ss in Group HA expressing significantly more favorable attitudes toward programmed instruction than the low n Ach Ss in the same group.

These attitudes may indicate that Ss with motivational characteristics which lead them to desire high achievement on an academic task also have favorable attitudes toward the level of difficulty of that program which enables them to maximize their performance.

An additional finding of interest was the effect on achievement of removing the confirming mechanism from the programs. As was noted, the variability in achievement as a function of program difficulty tends to be reduced when the confirming mechanism is removed. This result occurred in both the high and the low IQ groups and in all methods used in classifying Ss on motivational characteristics, thus it may be concluded that the effects of removing the confirming response are relatively consistent for the variables studied.

The removal of answers from a program that is perceived to be easy may reduce boredom, thereby increasing interaction with the learning conditions, thus improving achievement. Support for this view may be obtained from (1) the observation that three of the four high IQ groups achieved more on the low error rate program without answers, and (2) three of the four low IQ groups achieved equal to or less on the low error rate program without answers. It could be argued that for Ss with above average IQ's, the program with a low error rate with answers tended to be less challenging than it was for the Ss with below average IQ's.

On the high error rate program it is noted that all Ss, regardless of IQ, tended to do better on the program without answers. In a high error rate program with answers, it is probable that the amount of information presented in each frame was sufficiently great to lead S to look at the answer before learning all of the information presented in a frame. By removing the confirming answers from the program, the probability of avoiding interaction with the frame was reduced; thus, achievement was increased.

The difficulty of the original program (measured by error rate) lies somewhere between that of the low and the high error rate programs. The removal of the answers from the original program had the least effect on achievement. The program may have had a level of difficulty which neither bored nor frustrated Ss. If so, the removal of the answers would have little effect on achievement.

These observations lead to the conclusion that elimination of the confirmation mechanism in programs will result in improved achievement and that this will hold true for a range of program difficulties and levels of ability. An earlier study by Moore &

Smith (1961) suggested a similar conclusion.

Finally, it is of interest to note that Johnson (1963) and Battig (1965) report an interaction between level of task difficulty and retention in a paired associates task. Interference in learning (analagous to frames without confirmation) was detrimental to learning (immediate memory) but facilitated retention. It is conceivable that difficult programs require more attention and more effort thus enhancing retention.

CONCLUSIONS

1. High hostile press Ss generally achieved more than low hostile press Ss.
2. High need achievement Ss tended to achieve more than low need achievement Ss.
3. Ss who underestimated their level of achievement, scored at a higher level than Ss who overestimated their level of achievement.
4. A significant relationship was found between an S's estimate of his achievement and his performance on an academic task.
5. High hostile press Ss learned more from high error rate programs than from low error rate programs.
6. Low hostile press Ss tended to learn more from low error rate programs than from high error rate programs.
7. High hostile press Ss tended to have more favorable attitudes toward high error rate programs than toward low error rate programs.
8. Low hostile press Ss tended to have more favorable attitudes toward low error rate programs than toward high error rate programs.

9. High need achievement _S_s tended to have more favorable attitudes toward high error rate programs than did low need achievement _S_s.
10. Low need achievement _S_s tended to have more favorable attitudes toward low error rate programs than toward high error rate programs.
11. High hostile press _S_s tended to have more favorable attitudes toward programmed instruction than did low hostile press _S_s.
12. High need achievement _S_s tended to have more favorable attitudes toward programming than did low need achievement _S_s.

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APPENDIX A

Original Program
(With Answers)

TABLE I

Q1-1 In this section you will learn:

(1) the meaning of the word set

(2) the meaning of the two symbols, $\in$ and $\notin$

Q1-2 From the time you began playing with blocks as a little child, you began to notice how things were alike or different. Let us consider some things that are alike in some way. In what way is this group of names alike:

William, Harry, John, James?

A1-2

They are all names of boys.

Q1-3 (1) How are A, B, C, D, E alike?

(2) How are 1/2, 3/4, 5/8, 7/10 alike?

(3) How are Red, Blue, Green, Yellow alike?

A1-3

(1) They are all letters of the alphabet

(2) They are all fractions

(3) They are all names of colors

Q1-4 When we name a collection of objects, we often call the collection a "set". Usually they are alike in some way, and may be anything from the "set of blocks" you had as a child to a "set of problems" in mathematics.

(1) A carpenter has a ___?___ of tools.

(2) A mother has a ___?___ of dishes.

(3) A library has many ___?___ of books.

A1-4

(1) set

(2) set

(3) sets

Q1-5 Suppose I say I am thinking of the set of letters in our English alphabet; how many letters are there in this set?

A1-5 26

Q1-6 I am thinking of the set of months in a year. How many months are in the set?

A1-6 12

Q1-7 June is a member of the set of months in a year.

(1) C is a ___?___ of the set of letters contained in the English alphabet.

(2) 5/8 is a ___?___ of the set of fractions.

(3) .62 is a ___?___ of the ___?___ of decimal fractions.

(4) 37 is a ___?___ of the ___?___ of whole numbers.

A1-7

(1) member

(2) member

(3) member; set

(4) member; set

Q1-8 I am thinking of the set of days in the month of April. How many members are in this set?

A1-8 30

Q1-9 Red, white and blue are ___?___ of the ___?___ of colors.

A1-9 members; set

LOW ERROR PROGRAM
(Without Answers)

Q1. From the time you began playing with blocks as a little child, you began to notice how things were alike or different. Let us consider some things which are alike in some way.

(a) In what way is this group of names alike:
William, Harry, John?

(b) How are June, July and May alike?

A1.

Q2. When we talk about a collection of things, like the collection of names William, Harry, and John, we call the collection a "set" and the objects in the set members or elements. June is a member of the set of months in a year. Suppose I say I am thinking of the set of letters in the English alphabet; how many members are there in this set? Name the first four.

A2.

Q3. Green is a member of the set of colors. Refrigerator is not a member of the set of colors. Sometimes instead of the words "is a member of" the symbol $\in$ is used and instead of the words "is not a member of" $\notin$ is used. The symbol $\in$ can be written three ways: is a member of, is an element of, belongs to. What symbol could you use for these three expressions: is not a member of, is not an element of, does not belong to?

Rewrite the following sentence using the proper symbol:
John is a member of the band.

A3.

*Q4. What is a set? Begin your answer with the words: "A set is __________." What does the symbol $\in$ mean?

A4.

*Q5. Henry $\notin$ the band, while Mary $\in$ the band. What is the set here?

Write the three meanings of $\notin$.

A5.

Q6. 5/8 is a __________ of the __________ of fractions.

A6.

Q7. Friday is a member or an ____________ of the set of days in the week.

A7.

HIGH ERROR PROGRAM
(Without Answers)

Q1. From the time you began playing with blocks as a little child, you began to notice how things were alike or different. Let us consider some things that are alike in some way. In what way is this group of names alike?

William, Harry, John, James

A1.

Q2. When we name a collection of things, we often call the collection a "set". In order to have a set, we must have elements or members of the set.

Suppose we have the set of months of the year. How many elements are in this set? July is a ________ of the set of months of the year.

A2.

Q3. A set is a ____________ of things. Each "thing" is a part of the set. We express this three ways:

"is an element of"
"is a member of"
"belongs to"

Suppose the collection is the days of the week. Pick out one member of this and express it as a part of the set in the three ways.

A3.

Q4. Green is a member of the set of colors. Sometimes instead of the words "is a member of" or "belongs to" or "is an element of", we use the symbol $\in$.

(1) Copy the following sentence:

Pink is an element of the colors.

(2) Underline the words which may be replaced by $\in$.

(3) Rewrite the sentence you copied in (1) but replace the words you underlined by $\in$.

A4.

Q5. If an element is not a member of a set, we use the symbol $\notin$. This too has three meanings. Knowing what $\in$ means, what do you think $\notin$ means? (There will be three ways.)

A5.

*Q6. What is a set? Begin your answer "A set is __________."

What does the symbol $\in$ mean?

A6.

TABLE III

Moore-Hancock Student Estimate Test (S.E.)

The S.E. test included an easy test and a hard test each consisting of 100 simple addition problems presented by means of an overhead projector. On each test there were 28 criterion problems and 72 set problems.

Criterion Problems. These items were constructed of the digits 3 to 9 and were 6 digits in length. Examples of criterion items are:

6 6 8 5 3 9

5 3 7 4 9 7

The exposure times for criterion items varied from 1 to 13 seconds. The same 28 criterion items were inserted in both the easy and the hard tests in the same sequence (as determined by random selection). That is, criterion items appeared as the 5th, 8th, 14th, 16th, etc. problems, with respect to sequence, in both the easy and hard tests. The exposure time for each criterion item remained the same for both tests.

Set Items. These items form a background or "environment" for the criterion items. Unlike the criterion items, which are the same for both easy and hard tests, the set items differed with respect to difficulty. Actually it is the difference in the degree of difficulty of the set items that provided the distinction of "easy" and "hard" for the two tests. The easy set problems were composed only of digits from 1 to 3 and were 6 digits in length. Examples of easy set items are:

1 1 2 3 1 2

2 1 2 3 1 3

The hard set problems consisted of digits from 3 to 9 and were

TABLE III - continued

12 digits in length. Examples of hard set problems are:

6 8 4 7 9 3 5 4 4 8 6 3

3 7 9 3 8 5 3 6 5 9 8 7

The set problems contained in the hard test consisted of 36 easy set-items and 36 hard set-items found in the following sequence: easy, hard, easy, hard, etc.

The exposure time for the set items on both the hard and easy test was six seconds.

The Moore-Hancock Test was used to obtain a measure of student estimate of achievement. The formula which was used to obtain the student estimate was:

$$S.E. = \frac{(Exp.\ A + Exp.\ B) - (Act.\ A + Act.\ B)}{Total\ Expected\ (A + B)}$$

where: Exp. A means The number of problems the student expected to get right on the easy test (test A).

Exp. B means The number of problems the S expected to get right on the hard test (test B).

Act. A means The actual score or actual number of problems correct on the easy test (test A).

Act. B means The actual score of actual number of problems correct on the hard test (test B).

Total expected (A + B) means The number of problems the S expected to get correct on both tests. This quantity was used as a divisor to change the scores to a decimal.

TABLE III - continued

To illustrate the scoring method the following cases are presented.

number correct on easy (A) test = 60

number correct on hard (B) test = 50

number S though he got correct on easy test = 70

number S thought he got correct on hard test = 55

$$LA = \frac{(70 + 55) - (60 + 50)}{70 + 55} = \frac{125 - 110}{125} = \frac{15}{125} = .120$$

The student estimate score is a positive (+) .120, indicating that the expected number correct was greater than the actual number correct. The S's student estimate then, was higher than his performance.

An illustration of the situation where the expected number correct is below actual performance follows.

number correct on easy (A) test = 65

number correct on hard (B) test = 60

number S thought he got correct on easy test = 55

number S thought he got correct on hard test = 45

$$LA = \frac{(55 + 45) - (65 + 60)}{55 + 45} = \frac{100 - 125}{100} = \frac{-25}{100} = -.250$$

The student estimate score is a negative -.250, indicating that the expected number correct was less than the actual number correct. The student estimate then, was lower than his performance.

TABLE IV

Williamsport Project

Pretest Instructions

1. Have each student record his full name, section, and school in the upper right corner of the answer sheet.
2. Tell the students not to write on the test booklet but only on the answer sheet.
3. Read the following instructions to the class:

"This is a test of your achievement on certain kinds of arithmetic problems. Put the answer to each part of each question in the proper spaces on the answer sheets provided. If you need more space for any question, put the number of the question on the back of your paper and complete your answer there.

"We do not expect you to do well on this test because this is material you may never have seen before. It is the material you will be learning on the lessons you start tomorrow. You will receive no grade on this test, but you should try to do your best to answer the questions.

Are there any questions? Go ahead."

4. When the period is over, have the students who have not completed their tests pass them in separately from those who have completed them. This will allow us to return the uncompleted tests to the students for completion during the next period of arithmetic.

TABLE V

Williamsport Project

Instructions for Program Administrators

1. Give the students no help on the programs.
2. Have them record name, grade and section, unit or section of program, time spent during each period, and page number of each answer sheet.

   In the space labeled "Program", have them put their group number as indicated on the outside of the folder.
3. Collect completed and uncompleted units separately each day, so that students may continue the following day on uncompleted units.
4. If possible, keep all completed answer sheets for any given student together.
5. If a student has not completed the prescribed units for any given week, have him take home the incompleted units over the weekend and finish them.
6. Have students replace programs in order in the folders each day, since other classes will use the same folders. All programs (but not answer sheets) should be kept in the folders.
7. If any student is caught cheating on a program, reprimand him but do not take the paper.
8. If the students ask, they should be told that:
   - a. They should not change answers after looking at the correct ones.
   - b. There is no penalty for errors on the program.
   - c. Those without correct answers listed on their programs can do just as well in the final test as those with answers.
   - d. They should learn the material, since they will be graded on the exam given after the programs are completed.
   - e. They should circle the frame numbers on the answer sheet of the items they miss. This applies only to those with programs which have correct answers given on the program.

TABLE VI

Williamsport Project

Program Instructions

1. Have the students record their names, section, school, unit, page number, and total time spent each day on the answer sheet.
2. Instruct students not to write on the programs but only on the answer sheets.
3. Have them check to be sure that they have the folder with their name on it.
4. Read the following instructions aloud:

"The folders which you have on your desks contain some new arithmetic lessons that you and other classes will be working on for the next few weeks. Some of the students have booklets which are somewhat different than yours. However, students at Danville and Bloomsburg have already done these lessons, and they did equally well on each kind.

Now take out the booklet labeled Section 1. Don't write on the booklets, only on the answer sheets. Q1 indicates question 1. A1 indicates answer 1. Now cover your entire lesson except for Q1 with the answer sheet. On the answer sheet put a number 1 on the first line under 'Frame Number', read Q1, and put your answer on the answer sheet. . . . . . . .Now if you have answers, look at the answer to see if you have it right. If not, circle the frame number on your answer sheet. Now go to Q2 and do the same thing. . . . . . . .Are there any questions?

Although these lessons look like tests, they are not tests, and you will not be graded on them. There is thus no penalty for

TABLE VI - (continued)

wrong answers, so there is no reason to look at answers before writing them or to change answers after you see which one is correct.

When all the lessons have been completed, you will have a test on the material in them. Your grade on that test will be part of your grade in arithmetic.

Your teacher will not help you with these lessons, so there is no need to ask him (her). This is because these materials are self-instructional. Always be sure to use only the folder with your name on it and to replace the program sections in order after each class, since they will be used by people in other classes.

Are there any questions? Go ahead."

TABLE VII

P-Scale

Name ____________________

Group ____________________

1. Teachers and textbooks can teach much better than the self-teaching units which we used in class for the last month. (Check one)

_____ I strongly agree
_____ I agree
_____ I can't decide
_____ I disagree
_____ I strongly disagree

2. I think that most of the problems in the self-teaching units were: (Check one)

_____ too easy
_____ easy
_____ just right
_____ difficult
_____ too difficult

3. The problems I liked best were ones for which: (Check one)

_____ I could get the right answer without much thinking.
_____ I could get the right answer but I had to think before I got it.
_____ I usually (but not always) got the right answer.
_____ I got the wrong answer frequently even after thinking about it.

4. I liked the self-teaching approach in mathematics used this six weeks better than the usual way we are taught mathematics. (Check one)

_____ I strongly agree
_____ I agree
_____ I am uncertain
_____ I disagree
_____ I strongly disagree

5. If the answer to the problem was very easy for me it didn't make me feel particularly satisfied to know that I was right. (Check one)

_____ I strongly agree
_____ I agree
_____ I can't decide
_____ I disagree
_____ I strongly disagree

6. If it was difficult for me to get the correct answer to a problem, it made me feel very good when I found that I was right. (Check one)

_____ I strongly agree
_____ I agree
_____ I can't decide
_____ I disagree
_____ I strongly disagree

TABLE VII (continued)

7. If my teacher would teach me mathematics in class, I would rather use the self-teaching materials as homework rather than homework assignments from my regular mathematics book. (Check one)

_____ I strongly agree
_____ I agree
_____ I am uncertain
_____ I disagree
_____ I strongly disagree

8. I would like to: (Check one)

_____ go to college some day if I have the money
_____ get a job at the end of high school and not go to college even if I have enough money
_____ quit school as soon as I am old enough

9. (Check one)

_____ I would like to be on the honor roll every grading period if I could be
_____ Even if I were able to, I would not like to be on the honor roll every time. I am just as happy to have B's or C's and not have to work as hard.
_____ I really don't care very much about what kind of grades I receive.

10. I would like to use self-teaching materials like these some time again next year.

_____ I strongly agree
_____ I agree
_____ I am uncertain
_____ I disagree
_____ I strongly disagree

11. Your parents would like you to: (Check one)

____ go to college
____ get a good job as soon as you graduate from high school
____ get a job as soon as you are old enough without bothering about graduation from high school

12. What is your father's job, (or was, if he is not living); i.e., what kind of work does he do?

(a) ____
(b) What is your mother's job? ______________________________

13. I feel that the problems which I got right were the most fun to work on. (Check one)

_____ I strongly agree
_____ I agree
_____ I can't decide
_____ I disagree
_____ I strongly disagree

TABLE VII (continued)

14. I liked the self-teaching program because I could work as rapidly or as slowly as I pleased.

_____ I strongly agree
_____ I agree
_____ I am uncertain
_____ I disagree
_____ I strongly disagree

15. If you were to study self-teaching units in mathematics next year would you prefer problems which: (Check one)

_____ make you think harder than the problems which you have just completed?
_____ make you think about as hard as the problems which you have just finished?
_____ would be easier than the problems you have just completed?

16. Would you prefer to have the correct answer to each teaching frame or problem given to you as soon as you answered it?

____ Yes ____ No ____Don't care

17. Do you think you learned more from the self-teaching units in mathematics than you would have from a book and a teacher?

____ Yes ____ No ____Don't know

18. Were you bored with the self-teaching units more than you would have been in a regular class in mathematics?

____ Yes ____ No

19. (a) Did your father go to college? _____ Yes ____ No

(b) Did your mother go to college? _____ Yes ____ No

20. I would like to be a mathematician if I could learn most of my mathematics from self-teaching units like those on "sets". (Check one)

_____ I strongly agree
_____ I agree
_____ I can't decide
_____ I disagree
_____ I strongly disagree

21. I think that it would be a good idea for other schools to use these self-teaching mathematics materials. (Check one)

_____ I strongly agree
_____ I agree
_____ I am uncertain
_____ I disagree
_____ I strongly disagree

22. I like mathematics problems which are pretty difficult to solve. (Check one)

_____ I strongly agree
_____ I agree
_____ I can't decide
_____ I disagree
_____ I strongly disagree

TABLE VII (continued)

1. A general attitude (G.A.) toward programmed instruction was obtained by assigning values to the responses of items 1, 4, 7, 10, 14 and 21. The score on each item ranged from 1 to 5 with 5 points scored for a strongly favorable attitude toward programming, 4 for a favorable attitude, 3 points for an undecided response, etc.

2. A level of aspiration score (LA) was obtained by assigning values to the students' responses to items 8, 9 and 15.

3. A general attitude toward difficulty was obtained by assigning values to item 2. The scores ranged from 1 to 5 with 1 being a "too easy" response and 5 the "too difficult" response.

TABLE VIII

SETS - WILLIAMSPORT

Date	Groups 1 & 2	Date	Groups 3 &4, 5 &6
April 17	Unit 1	April 17	Section I
	Unit 2		Section I
April 19	Unit 3		Section I
April 22	Unit 4	April 22	Section I
	Unit 5	April 23	Section II and Review I
	Unit 6		
	Unit 7	April 25	Section II and Review I
	Unit 8		
April 26	Unit 9	April 26	Section III
April 29	Unit 10	May 1	Section III
	Unit 11	May 2	Section IV
	Unit 12	May 7	Section IV
	Unit 13	May 8	Section V and Review
May 3	Unit 14		
May 6	Unit 15	May 10	Section V and Review
	Unit 16		
	Unit 17		
	Unit 18		
May 10	Unit 19		

TABLE IX

ACHIEVEMENT TEST AND RETENTION TEST
(Total Score Possible = 100 points)

1. Write the symbols for:
    a. is not an element of
    b. the complement of N
    c. is a subset of
    d. the universal set

2. In the set $A = \{a, b, c\}$ there are eight subsets. List all of them. Circle the improper subset. Underline the subset of every set.

3. Explain in a few words:
    a. natural numbers
    b. empty or null set
    c. domain
    d. subset

4. Write the symbols for:
    a. multiplication
    b. is not a subset of
    c. intersection
    d. union

5. Explain in a few words:
    a. integer
    b. inequality
    c. the complement of a set
    d. union of A and B
    e. identity

6. Tell whether these pairs of sets are disjoint, intersecting, equal or one is a subset of the other.
    a. $A = \{2, 4, 6, 8, 10\}$ $B = \{2, 8, 10, 16, 4, 12\}$
    b. $A = \{2, 6, 4, 10, 12, 14\}$ $B = \{4, 6, 10, 2, 10\}$
    c. $A = \{2, 4, 6, 8, 10\}$ $B = \{12, 14, 16, 18\}$
    d. $A = \{2, 4, 6, 8, 10\}$ $B = \{10, 4, 6, 2, 8\}$
    e. $A = \{2, 4, 6, 8, 10\}$ $B = \{6, 10, 2, 4, 8, 12, 6, 2, 10\}$

7. Write the symbols for:
    a. the set containing
    b. equal to
    c. is less than
    d. is a member of

8. Explain in a few words:
    a. counting numbers
    b. variable
    c. the intersection of A and B
    d. finite set

TABLE IX (continued

9. Consider these sets: $B = \{4, 8, 12. . . . .\}$
$C = \{4, 8, 12. . . .60\}$

Answer True or False:

a. $20 \in B$
b. $84 \in B$
c. $18 \notin C$
d. $20 \notin C$
e. $60 \in B$
f. $2 \in C$
g. B is an infinite set
h. $26 \in B$

10. Write the symbols for:
  a. is not greater than
  b. is less than or equal to
  c. is not equal to
  d. the continuation of a sequence of numbers

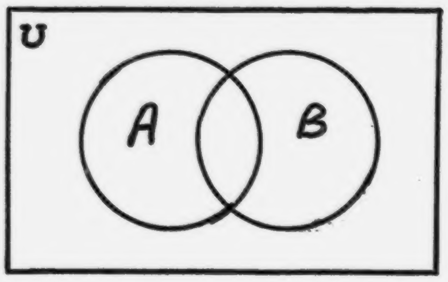
11. Suppose: $U = \{n \mid n + 2 \geq 2 \text{ and } n \in \text{whole numbers}\}$

$A = \{n \mid n \leq 4 \text{ or } n \geq 8\}$
$B = \{n \mid 3 \leq n < 7\}$
$C = \{n \mid 3n \leq n + 12\}$

  a. List members of each of the sets above.
  b. Make a sketch on a number line of B and C.
  c. Find B'.
  d. Find $B \cup C$.
  e. Find $A \cap C$.
  f. Find $A \cap B \cap C$
  g. Find $A' \cap B \cap C$
  h. Find $C' \cap B$

12. Write the symbols for:
  a. is greater than
  b. is not less than
  c. the null or empty set
  d. is greater than or equal to

13. Using a copy of this model for each drawing, make Venn diagrams and shade the part to show the portions represented:
  a. $A \cap B$
  b. $A \cup B$
  c. B'
  d. $A' \cup B$
  e. $A \cap B'$



APPENDIX B

TABLE I

High IQ Males, Hostile Press

High hostile press	N	Post	Comb.	N	Retn.	Comb.
Low error rate with answers	7	50.4	57.7	7	39.6	45.7
Low error rate without answers	8	64.0		7	51.8	
Original with answers	7	77.0	65.8	6	57.8	46.8
Original without answers	8	56.0		7	37.3	
High error rate with answers	7	64.6	63.2	7	49.6	50.8
High error rate without answers	10	62.2		10	51.7	
Totals	47	62.2	62.2	44	48.0	48.0
Low hostile press						
Low error rate with answers	3	43.0	49.6	2	52.0	45.3
Low error rate without answers	5	53.6		4	42.0	
Original with answers	9	65.9	65.5	9	47.1	45.8
Original without answers	8	65.0		7	44.0	
High error rate with answers	10	53.0	56.4	9	36.6	38.7
High error rate without answers	8	60.6		6	41.8	
Totals	43	58.7	58.7	37	42.8	42.8

TABLE II

High I.Q. females only hostile press						
High hostile press	**N**	**Post**	**Comb.**	**N**	**Retn.**	**Comb.**
Low error rate with answers	10	56.7	62.6	9	44.0	49.3
Low error rate without answers	10	68.5		9	54.7	
Original with answers	13	65.3	66.0	13	46.0	46.5
Original without answers	12	66.8		11	47.1	
High error rate with answers	8	63.1	66.5	8	45.0	53.6
High error rate without answers	11	69.0		9	61.2	
Totals	64	65.1	65.1	59	49.4	49.4
Low hostile press						
Low error rate with answers	7	65.4	65.9	6	43.7	43.7
Low error rate without answers	12	66.2		12	58.7	
Original with answers	7	59.6	61.4	6	42.2	44.9
Original without answers	5	64.0		6	47.7	
High error rate with answers	9	56.7	60.3	9	46.9	48.9
High error rate without answers	6	65.7		6	52.0	
Totals	46	62.9	62.9	45	49.8	49.8

TABLE III

Low I.Q. males and females hostile press				
High hostile press	**N**	**Post**	**N**	**Retn.**
Low error rate with answers	11	45.9	11	25.6
Low error rate without answers	9	35.7	10	23.2
Original with answers	10	40.0	7	24.4
Original without answers	20	37.0	17	25.2
High error rate with answers	14	36.1	14	30.8
High error rate without answers	11	39.1	8	31.1
Totals	75	38.7	67	26.8
Low hostile press				
Low error rate with answers	19	33.1	17	19.9
Low error rate without answers	19	34.8	14	24.1
Original with answers	19	32.8	18	19.6
Original without answers	19	34.0	18	23.3
High error rate with answers	20	28.3	18	21.7
High error rate without answers	26	34.2	24	20.7
Totals	122	32.9	109	21.4

TABLE IV

Low I.Q. males hostile press						
High hostile press	**N**	**Post**	**Comb.**	**N**	**Retn.**	**Comb.**
Low error rate with answers	5	53.0	41.9	5	29.0	26.0
Low error rate without answers	5	30.8		5	23.0	
Original with answers	4	32.8	32.2	3	21.7	19.8
Original without answers	10	32.0		9	19.2	
High error rate with answers	7	27.7	32.0	7	27.1	30.0
High error rate without answers	4	39.5		2	40.0	
Totals	35	34.9	34.9	31	24.8	24.8
Low hostile press						
Low error rate with answers	12	29.4	30.0	12	16.1	17.9
Low error rate without answers	8	30.9		5	22.4	
Original with answers	10	29.2	28.4	9	13.0	15.3
Original without answers	7	27.3		6	18.8	
High error rate with answers	8	22.4	28.6	6	21.3	19.1
High error rate without answers	12	32.8		11	17.9	
Totals	57	29.0	29.0	49	17.6	17.6

TABLE V

Low I.Q. females hostile press						
High hostile press	N	Post	Comb	N	Retn.	Comb
Low error rate with answers	5	41.8	38.8	5	25.0	21.9
Low error rate without answers	3	33.7		3	16.7	
Original with answers	5	43.6	43.8	4	25.5	33.8
Original without answers	7	43.8		5	39.6	
High error rate with answers	6	47.0	44.6	6	37.2	34.8
High error rate without answers	6	42.2		5	32.0	
Totals	32	42.8	42.8	28	30.8	30.8
Low hostile press						
Low error rate with answers	7	39.4	38.8	6	23.3	25.8
Low error rate without answers	9	38.3		7	23.7	
Original with answers	10	34.7	35.3	10	24.8	24.1
Original without answers	11	35.9		11	23.4	
High error rate with answers	10	31.1	33.6	9	21.8	22.9
High error rate without answers	14	35.4		14	23.6	
Totals	61	35.6	35.6	57	24.0	24.0

TABLE VI

Adjusted mean post-test scores for high I.Q. males and females on high and low need achievement

Program	High need achievement		Low need achievement	
	N	Adjusted Post	N	Adjusted Post
Low error rate with answers	16	58.7	10	52.7
Low error rate without answers	23	66.7	10	65.6
Original with answers	17	66.4	18	67.4
Original without answers	15	65.1	14	67.1
High error rate with answers	17	59.9	12	59.2
High error rate without answers	22	65.8	13	62.8
Totals	110	64.0	77	63.2

TABLE VII

Adjusted means for high I.Q. males on need achievement for post and retention tests

High need achievement	N	Post	Comb	N	Retn.	Comb
Low error rate with answers	5	49.0	58.0	5	40.2	47.8
Low error rate without answers	10	62.5		8	52.5	
Original with answers	8	68.4	61.4	8	49.6	42.5
Original without answers	9	55.2		7	34.3	
High error rate with answers	13	60.3	60.3	12	43.0	44.1
High error rate without answers	11	60.4		11	45.4	
Totals	56	60.0	60.0	51	44.6	44.6
Low need achievement						
Low error rate with answers	4	40.2	45.1	3	42.3	39.7
Low error rate without answers	3	51.7		3	37.0	
Original with answers	7	72.8	70.1	6	52.7	50.0
Original without answers	6	66.8		6	47.2	
High error rate with answers	4	49.5	57.9	4	40.0	47.7
High error rate without answers	5	64.6		5	53.8	
Totals	29	60.3	60.3	27	46.9	46.9

TABLE VIII

Adjusted means high I.Q. females high and low need achievement post and retention

High need achievement	N	Post	Comb	N	Retn.	Comb
Low error rate with answers	12	60.1	64.7	11	43.4	51.6
Low error rate without answers	14	68.4		14	57.9	
Original with answers	10	65.6	64.8	10	47.3	46.7
Original without answers	9	63.9		8	45.9	
High error rate with answers	9	57.8	64.2	9	41.3	51.6
High error rate without answers	11	69.4		9	61.8	
Totals	65	64.6	64.5	61	50.1	50.1
Low need achievement						
Low error rate with answers	6	61.0	63.5	5	44.0	50.4
Low error rate without answers	8	65.4		7	55.0	
Original with answers	10	61.0	64.2	9	42.0	46.5
Original without answers	8	68.2		8	51.5	
High error rate with answers	8	61.9	62.5	7	54.3	52.6
High error rate without answers	5	63.6		5	50.2	
Totals	45	63.5	63.5	41	49.4	49.4

TABLE IX

Adjusted means for low IQ male and female Ss on high and low need achievement for post and retention

High need achievement	N	Adj. Post	N	Adj. Retn.
Low error rate with answers	15	40.7	14	24.1
Low error rate without answers	13	37.0	11	25.2
Original with answers	14	41.4	12	26.6
Original without answers	16	40.3	15	26.0
High error rate with answers	15	35.8	15	31.0
High error rate without answers	14	36.0	12	28.0
Total	87	39.8	79	26.7
Low need achievement	N	Adj. Post	N	Adj.Retn.
Low error rate with answers	14	34.1	14	19.1
Low error rate without answers	15	34.1	12	23.7
Original with answers	15	31.6	13	17.4
Original without answers	22	32.0	19	22.9
High error rate with answers	19	25.9	17	23.3
High error rate without answers	23	35.2	21	20.5
Total	108	31.2	96	20.7

TABLE X

Low I.Q. males on high and low need achievement for post and retention tests

High need achievement	N	Post	Comb	N	Retn	Comb
Low error rate with answers	8	38.1	33.4	8	21.8	22.5
Low error rate without answers	5	26.0		4	21.0	
Original with answers	6	39.7	34.5	5	17.4	18.4
Original without answers	6	29.5		5	19.4	
High error rate with answers	5	29.4	31.4	5	19.6	24.4
High error rate without answers	9	32.4		7	27.8	
Totals	39	33.0	33.0	34	22.0	22.0
Low need achievement						
Low error rate with answers	9	34.7	34.3	9	18.2	19.7
Low error rate without answers	8	33.8		6	21.8	
Original with answers	7	21.6	26.4	6	10.2	16.2
Original without answers	10	29.8		9	20.2	
High error rate with answers	9	23.4	29.4	8	26.0	20.7
High error rate without answers	7	37.0		6	13.7	
Totals	50	30.1	30.1	44	18.8	18.8

TABLE XI

Adjusted means for low I.Q. females on high and low need achievement on post and retention tests

High need achievement	N	Post	Comb	N	Retn	Comb
Low error rate with answers	8	41.2	41.0	7	27.0	24.7
Low error rate without answers	8	40.8		7	22.4	
Original with answers	10	41.2	41.0	9	29.0	27.9
Original without answers	9	40.9		9	26.8	
High error rate with answers	10	42.5	42.9	10	32.1	32.1
High error rate without answers	8	43.8		7	32.1	
Totals	53	41.7	41.7	49	28.5	28.5
Low need achievement						
Low error rate with answers	3	40.0	34.3	3	25.0	22.3
Low error rate without answers	4	30.0		3	19.7	
Original with answers	5	30.6	34.8	5	18.1	25.9
Original without answers	9	37.1		7	30.6	
High error rate with answers	6	28.0	31.7	5	19.6	20.8
High error rate without answers	12	33.5		11	21.4	
Totals	39	33.2	33.2	34	22.8	22.8